Soil Remedial Technologies, Tower Standard Site, Lac du Flambeau Reservation, Wisconsin				
Remedial Technology For Soil	**Description**	**Disadvantages**	**Advantages**	**Notes**
Excavation	Excavation of contaminated soils followed by either treatment and disposal or disposal at landfill.	• Excavation below the water table is not easy and may leave contamination that still requires treatment • Footprint of excavation could become quite large to avoid sidewall collapse • Dewatering to get to deeper contamination would generate water that would need to be treated and disposed of offsite • Dewatering may lead to increase in smear zone • Excavation may be limited by encroachment of road right of way or road prism • Lincoln County Landfill is over one hour away • Vapor emission from open excavation may impact local businesses and residents • Potential for fugitive dust emissions • May increase groundwater contamination by agitating soils beneath the water table • Transportation and disposal costs are high	• Complete removal of contaminated soils excavated • Demonstrated success • Timeframe for total removal less than 3 months	• Can be combined with other technologies • Would require temporary fencing while excavation is open

Soil Remedial Technologies, Tower Standard Site, Lac du Flambeau Reservation, Wisconsin				
Remedial Technology For Soil	**Description**	**Disadvantages**	**Advantages**	**Notes**
Soil Vapor Extraction (SVE)	In situ method that removes volatile compounds from the subsurface using SVE wells and vacuum blower	• Treats only the unsaturated soils • Requires installation of SVE wells and piping. • Shallow depth to groundwater may require horizontal wells • Requires above ground equipment treatment unit • Off gas emission treatment may be required	• Demonstrated success • Treatment units readily available • Timeframe for removal less than 3 years • Moderate cost	• Generally combined with air sparging • Can be combined with excavation of shallow soils and installing the horizontal SVE wells during backfilling
Air Sparging (AS)	In situ method that removes volatile compounds from the subsurface using air sparge wells and compressor to blow air below the groundwater table	• Requires installation of AS wells and piping to an above ground equipment treatment unit	• Demonstrated success • Treatment units readily available • Treats saturated soils • Also supplies oxygen to stimulate biodegradation • Timeframe for removal less than 3 years • Moderate cost	• Pilot study to evaluate AS well spacing and concern about potential iron fouling of the AS wells

Soil Remedial Technologies, Tower Standard Site, Lac du Flambeau Reservation, Wisconsin				
Remedial Technology For Soil	**Description**	**Disadvantages**	**Advantages**	**Notes**
Enhanced Bioremediation	Addition of oxygen to the subsurface by either injection points, air sparging, or applying to open excavations	• Requires multiple applications if an oxygen release compound or other amendment is used	• Easy injection using direct push methods because of shallow groundwater	• Injection of an oxygen release compound may not meet tribal regulations • Oxygen release compound can be applied to an open excavation, though professional experience indicates this method has limited efficacy
Chemical oxidation	Addition of a chemical oxidant to the subsurface to destroy the contaminant.	• Requires multiple applications • Potential changes to groundwater geochemistry • High cost	• Easy injection using direct push methods because of shallow groundwater • Can readily target soils beneath the water table • Short treatment time (3 months to 1 year)	• Injection of an oxidant may not meet tribal regulations.

Soil Remedial Technologies, Tower Standard Site, Lac du Flambeau Reservation, Wisconsin				
Remedial Technology For Soil	**Description**	**Disadvantages**	**Advantages**	**Notes**
In Situ Soil Heating	Addition of heat to the subsurface to volatilize contaminants.	• Requires installation of heating wells and is typically combined with SVE • Off gas emission treatment may be required • Condensate may be generated and would require disposal • High cost	• Short treatment timeframe (6 to 9 months)	• High energy demand that may not be readily available resulting in the need for portable generators

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